Selection Statement
for the
Space Launch System
Advanced Booster Engineering Demonstration and/or Risk Reduction
NASA Research Announcement
Solicitation Number NNM12ZPS001N

On June 29, 2012, I, along with other senior officials of NASA Headquarters and NASA's Marshall Space Flight Center (MSFC), met with the evaluation team appointed to evaluate proposals in connection with the Space Launch System (SLS) Advanced Booster Engineering Demonstration and/or Risk Reduction (ABEDRR) NASA Research Announcement (NRA).

I. PROCUREMENT HISTORY

The purpose of this NRA is to (1) reduce risks leading to an affordable Advanced Booster that meets the evolved capabilities of SLS and (2) enable competition by mitigating targeted Advanced Booster risks to enhance SLS affordability.

The ABEDRR NRA solicited proposals that would enhance affordability, improve reliability, and meet the specified SLS vehicle mission performance requirements. The NRA requested offerors to (1) propose an Advanced Booster concept in accordance with a set of top-level performance requirements, (2) identify and rank the most relevant risks associated with the proposed concept, and (3) propose engineering demonstration and/or risk reduction (EDRR) efforts associated with key risks.

The SLS ABEDRR NRA was released on February 9, 2012. On April 9, 2012, eight proposals were received from the following seven companies: Aerojet General Corporation; The Boeing Company; Northrop Grumman Systems Corporation Aerospace Systems; Blue Origin, LLC; Lockheed Martin Space Systems Company; Dynetics, Inc.; ATK Launch Systems, Inc. All of the proposals were determined to be compliant with the SLS ABEDRR NRA and were evaluated.

The selection is expected to result in firm-fixed-price contracts having a period of performance beginning on or about October 1, 2012, and ending on March 31, 2015.

II. EVALUATION OF PROPOSALS

The proposals were evaluated in accordance with the NRA. The evaluation criteria consisted of three factors: (1) Relevance to NASA Objectives, (2) Intrinsic Merit, and (3) Price. All three factors were essentially equal in importance. The selection of proposals was also based on the offeror's Advanced Booster concept, the proposed EDRR efforts, and funding availability.

Under the Relevance to NASA Objectives factor, the evaluation team assessed the extent to which the submitted Advanced Booster concept(s) and the proposed EDRR effort(s) enhanced affordability, improved reliability, and met the performance requirements. Under this factor, each proposal was assessed strengths and/or weaknesses. The strengths and weaknesses were consolidated and identified in descending order of importance with significance assigned as appropriate in accordance with the following:

Significant Strength - An aspect of the proposal that greatly enhances the merit of the proposal or the potential for successful contract performance.

Strength - An aspect of the proposal that will have some positive impact on the merit of the proposal or the potential for successful performance of the contract.

Significant Weakness - A flaw that appreciably decreases the merit of the proposal or increases the risk of unsuccessful contract performance.

Weakness - A flaw in the proposal that decreases the merit of the proposal or increases the risk of unsuccessful contract performance.

Subsequently, a consensus adjectival rating for each proposed concept was assigned under this factor in accordance with the following:

Excellent - Exceptional merit that fully responds to the objectives of the NRA as documented by numerous or significant strengths and has no significant weaknesses.

Very Good - High merit that fully responds to the objectives of the NRA and strengths outweigh any weaknesses.

Good - Credible response to the NRA and strengths and weaknesses essentially balance each other out.

Fair - Nominal response to the NRA but weaknesses outweigh any strengths.

Poor - Flawed response having weaknesses that significantly outweigh strengths.

Under the Intrinsic Merit factor, the management approach, technical approach, and small business utilization (all which are further defined in the NRA) as well as the approach to the model contract were assessed. Under this factor, each EDRR effort was assessed for strengths and/or weaknesses (defined above). The strengths and weaknesses were consolidated and identified in descending order of importance with significance assigned as appropriate. Subsequently, a consensus adjectival rating (defined above) for each EDRR effort was assigned.

Under the Price factor, the total price for each EDRR effort was evaluated for reasonableness and completeness. In addition, the extent to which the proposal complied with the anticipated funding allocation and phasing in the NRA was evaluated. Under this factor, findings were consolidated and identified in descending order of importance as appropriate. Subsequently, a consensus level of confidence to successfully perform at the proposed price was assigned to each EDRR effort. The level of confidence was expressed as "High," "Medium," or "Low" in accordance with the following:

> High - The Government has a very high level of confidence that the offeror can perform successfully at or below the proposed price.
>
> Medium - The Government has a reasonable level of confidence that the offeror can perform successfully at or below the proposed price.
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> Low - The Government has a marginal level of confidence that the offeror can perform successfully at or below the proposed price.

As indicated, eight proposals were submitted for evaluation. The following is a summary of the EDRR efforts selected for negotiation. The EDRR efforts are presented in the order that relates to the order in which the proposals were evaluated, which was randomly determined by a drawing.

Northrop Grumman Systems Corporation Aerospace Systems
EDRR 1, Subscale Composite Tank Set

Under the Relevance to NASA Objectives factor, the proposed concept for the Advanced Booster received an adjectival rating of "Very Good" resulting from one significant strength, twelve strengths, no significant weaknesses, and ten weaknesses. The significant strength related to the incorporation of several cost-reducing measures to enhance affordability. The strengths related to (1) the approach for managing costs, (2) in-situ manufacturing, (3) use of some heritage engine components, (4) the affordability plan, (5) use of composite propellant tanks, (6) use of refined petroleum (RP) fuel, (7) use of a composite airframe, (8) use of selective throttling for thrust vector control, (9) use of existing design for booster attachment, (10) a preliminary analysis on steering control, (11) use of ballistic blankets, and (12) improved booster reliability. The weaknesses related to (1) an inconsistent aft skirt design, (2) an inadequate description of the attachment of the booster to the mobile launch platform, (3) the mitigation of relevant risks, (4) vehicle control, (5) affordability for modifications to the mobile launch platform, (6) use of complex geometry for oxygen feed lines, (7) thermal protection, (8) assumptions about use of NASA facilities, (9) retirement costs, and (10) launch processing requirements.

Under the Intrinsic Merit factor, EDRR 1 received an adjectival rating of "Excellent" resulting from one significant strength, four strengths, no significant weaknesses, and seven weaknesses. The significant strength related to the approach for mitigating risks associated with

the construction of composite tanks. The strengths related to (1) the approach for achieving affordability and reliability, (2) use of existing tooling, (3) the approach to communicating with NASA, and (4) use of earned value management. The weaknesses related to (1) identification of data products, (2) milestone payments, (3) scheduling details, (4) testing details in the statement of work, (5) communication details in the statement of work, (6) small business subcontracting goals, and (7) the master subcontracting plan.

Under the Price factor, EDRR 1 received a cost confidence rating of "Medium."

Aerojet General Corporation
EDRR 1, Full-Scale Combustion Stability Demonstration

Under the Relevance to NASA Objectives factor, the proposed concept for the Advanced Booster received an adjectival rating of "Very Good" resulting from no significant strengths, ten strengths, no significant weaknesses, and seven weaknesses. The strengths related to (1) the capability to handle engine failure, (2) use of a common manufacturing base, (3) the approach to reducing engine weight that increases reliability, (4) hydraulic innovations for thrust vector control, (5) use of refined petroleum (RP) fuel, (6) the commitment to affordability strategies, (7) use of standard engine configurations, (8) the engine mounting frame, (9) the focus on risks related to schedule, and (10) use of an oxygen rich stage combustion (ORSC) engine cycle. The weaknesses related to (1) a pre-contract effort, (2) the identification and prioritization of risks, (3) inadequate information concerning the approach to insight/oversight, (4) the proposed pre-burner arrangement, (5) oxygen resistant coatings, (6) unsubstantiated cost estimates for modifications to the mobile launch platform, and (7) the rough-order-of magnitude (ROM) estimate for the design, development, test, and evaluation phase.

Under the Intrinsic Merit factor, EDRR 1 received an adjectival rating of "Very Good" resulting from no significant strengths, thirteen strengths, one significant weakness, and four weaknesses. The strengths related to (1) the approach for reducing cost and schedule risk by addressing ORSC engine stability, (2) comprehensive test objectives, (3) test team dynamics, (4) extensive experience and current activity with ORSC engines, (5) the technical approach, (6) existing test data, (7) ongoing sub-scale design and testing activity, (8) data deliverables, (9) use of experts from industry, (10) the communication plan, (11) unique skills sets, (12) team qualifications, and (13) small business utilization. The significant weakness related to delivery of data. The weaknesses related to (1) coordination with ongoing development activities, (2) approach to full-scale engine development, (3) implementation of affordability strategies, and (4) the schedule.

Under the Price factor, EDRR 1 received a cost confidence rating of "Medium."

Dynetics, Inc.
EDRR 1, F1 Engine Risk Reduction Task

Under the Relevance to NASA Objectives factor, the proposed concept for the Advanced Booster received an adjectival rating of "Excellent" resulting from two significant strengths, thirteen strengths, no significant weaknesses, and one weakness. The significant strengths related to (1) many affordability enhancements and (2) use of a simple and robust design. The strengths related to (1) the approach for loss of engine, (2) the approach for collecting data and knowledge, (3) the simplified design for the main propulsion system, (4) the analysis of proposed activities vis-à-vis cost and schedule, (5) the approach for improving reliability, (6) engine throttling capability, (7) use of an engine with gas generator (GG) cycle, (8) use of refined petroleum (RP) fuel, (9) the approach to cost savings, (10) the approach to manufacturing and assembly, (11) the approach for transporting the boosters, (12) affordability strategies, and (13) a demonstrated understanding of relevant risks. The weakness related to a lack of clarity with respect to the mitigation of a facility risk.

Under the Intrinsic Merit factor, EDRR 1 received an adjectival rating of "Excellent" resulting from three significant strengths, thirteen strengths, no significant weaknesses, and three weaknesses. The significant strengths related to (1) a hot-fire test of a power pack with the potential to significantly reduce cost and schedule, (2) a fabrication technique for the main combustion chamber that reduces complexity, manufacturing time, and cost, and (3) manufacturing demonstration of a full-size GG injector using modern manufacturing techniques. The strengths related to (1) the approach to simplify and improve the design of the turbo pump, (2) the approach for throttling capability, (3) the benefit of previous investments, (4) the experience of the test team, (5) comprehensive test objectives, (6) the approach to start testing with existing hardware while waiting for fabrication of modernized parts, (7) the approach to mitigating programmatic risk, (8) use of subcontractors with established working relationships, (9) data deliverables, (10) the approach to fee, (11) a thorough schedule, (12) small business subcontracting goals, and (13) providing small business with meaningful work. The weaknesses related to (1) the affordability strategy, (2) rights in data, and (3) risk mitigation.

Under the Price factor, EDRR 1 received a cost confidence rating of "High."

Dynetics, Inc.
EDRR 2, Main Propulsion System Risk Reduction Task

Under the Relevance to NASA Objectives factor, as stated, the proposed concept for the Advanced Booster received an adjectival rating of "Excellent" resulting from two significant strengths, thirteen strengths, no significant weaknesses, and one weakness.

Under the Intrinsic Merit factor, EDRR 2 received an adjectival rating of "Very Good" resulting from no significant strengths, eight strengths, no significant weaknesses, and three weaknesses. The strengths related to (1) the fabrication and testing of main propulsion components based on a simplified design and use of modern materials, (2) the approach to

mitigating programmatic risk, (3) use of subcontractors with established working relationships, (4) data deliverables, (5) the approach to fee, (6) a thorough schedule, (7) small business subcontracting goals, and (8) providing small business with meaningful work. The weaknesses related to (1) the affordability strategy, (2) rights in data, and (3) risk mitigation.

Under the Price factor, EDRR 1 received a cost confidence rating of "High."

Dynetics, Inc.
EDRR 3, Structures Risk Reduction Task

Under the Relevance to NASA Objectives factor, as stated, the proposed concept for the Advanced Booster received an adjectival rating of "Excellent" resulting from two significant strengths, thirteen strengths, no significant weaknesses, and one weakness.

Under the Intrinsic Merit factor, EDRR 3 received an adjectival rating of "Excellent" resulting from one significant strength, eight strengths, no significant weaknesses, and three weaknesses. The significant strength related to the fabrication of cryogenic tanks using fewer materials and processes and common components. The strengths related to (1) the enhancement to affordability as a result of using a simplified and robust tank design, (2) the approach to mitigating programmatic risk, (3) use of subcontractors with established working relationships, (4) data deliverables, (5) the approach to fee, (6) a thorough schedule, (7) small business subcontracting goals, and (8) providing small business with meaningful work. The weaknesses related to (1) the affordability strategy, (2) rights in data, and (3) risk mitigation.

Under the Price factor, EDRR 1 received a cost confidence rating of "High."

ATK Launch Systems, Inc.
EDRR 3, Integrated Booster Static Test

Under the Relevance to NASA Objectives factor, the proposed concept for the Advanced Booster received an adjectival rating of "Excellent" resulting from three significant strengths, ten strengths, no significant weaknesses, and eight weaknesses. The significant strengths related to (1) a design approach that enhances affordability and reliability, (2) a manufacturing approach that enhances affordability, and (3) continuous health monitoring of structures. The strengths related to (1) the approach to thrust vector control, and (2) improved reliability and enhanced affordability that exceed performance requirements, (3) a damage-tolerant composite case (4) leveraged use of both human-rated and commercial experience, (5) launch site operations, (6) use of flight-proven designs, (7) relevant experience, (8) use of automated propellant processing facility, (9) approach to mitigating structural impacts, and (10) use of fewer case segments. The weaknesses related to (1) claimed cost savings, (2) the identification and prioritization of risks, (3) assumptions related to production, (4) proposed preparation by NASA of "should-cost" estimates, (5) impacts from transportation, (6) the understanding of affordability, (7) retirement costs, and (8) elimination of testing without adequate rationale.

Under the Intrinsic Merit factor, EDRR 3 received an adjectival rating of "Very Good" resulting from one significant strength, five strengths, one significant weakness, and three weaknesses. The significant strength related to the incorporation of nearly all advanced features and manufacturing techniques in a hot-fire test in an effort to address numerous risks. The strengths related to (1) the approach for monitoring composite structures from assembly through operation, (2) use of discretionary funding for complementary technologies, (3) use of an appropriate combination of both heritage and modernized components, (4) use of earned value management, and (5) providing small business with meaningful work. The significant weakness related to data delivery. The weaknesses related to (1) the coordination and approval regarding use of government-furnished property, (2) a proposed contract clause for government property, and (3) the proposed use of government facilities.

Under the Price factor, EDRR 1 received a cost confidence rating of "Medium."

III. SELECTION DECISION

During the presentation, I carefully considered the detailed findings of the NRA evaluation team and the team's responses to my questions about those findings. I also solicited and considered the views of key senior personnel who attended the presentation with me. These key senior personnel have responsibility related to this procurement and understood the application of the evaluation factors set forth in the NRA.

Although I agreed with findings presented by the NRA evaluation team, I also recognized it was my responsibility as the selection official to examine the findings for each proposal and use my independent judgment to determine the appropriate discriminators for purposes of selection. Therefore, after careful consideration of the detailed findings and my interactions with the evaluation team and key senior advisors, I determined that (1) the findings resulted from a thorough and accurate review of the proposals and (2) the adjectival and cost confidence ratings were supported by the underlying findings and therefore accurately reflected the relative standing of the proposals under each of the three evaluation factors (i.e., relevance to NASA objectives, intrinsic merit, and price).

Next, I determined that the EDRR efforts that represented the best value to NASA received (1) a rating of either "Excellent" or "Very Good" under the Relevance to NASA Objectives factor, (2) a rating of either "Excellent" or "Very Good" under the Intrinsic Merit factor, and (3) received a price confidence rating of either "High" or "Medium" under the Price factor. Consequently, I eliminated all EDRR efforts that did not meet these criteria.

From the remaining proposals, I selected (1) EDRR 1 proposed by Northrop Grumman Systems Corporation Aerospace Systems, (2) EDRR 1 proposed by Aerojet General Corporation, (3) EDRRs 1, 2, and 3 proposed by Dynetics, Inc., and (4) EDRR 3 proposed by ATK Launch Systems, Inc. for negotiation.

Northrop Grumman received a rating of "Very Good" under the Relevance to NASA Objectives factor. EDRR 1, entitled "Subscale Composite Tank Set" received a rating of "Excellent" under the Intrinsic Merit factor and a confidence level of "Medium" under the Price factor. The proposed price is reasonable for the proposed work. Northrop Grumman's EDRR 1 will demonstrate innovative manufacturing/fabrication techniques for composite structures. Of particular importance was the in-situ manufacturing process for large composite tanks and structures. This process could be very beneficial to the production of such large tanks and structures in the future.

Aerojet received a rating of "Very Good" under the Relevance to NASA Objectives factor. EDRR 1, entitled "Full-Scale Combustion Stability Demonstration," received a rating of "Very Good" under the Intrinsic Merit factor and a confidence level of "Medium" under the Price factor. Aerojet's EDRR 1 will demonstrate combustion stability for an oxygen rich staged combustion (ORSC) rocket engine for use in connection with a liquid oxygen, refined petroleum (LOX/RP) booster. This proposed EDRR effort provides a good value and addresses a key risk associated with the combustion stability. While the proposed price is reasonable for the proposed work under this EDRR effort, some cost savings may be available here if this EDRR effort can be synergistically combined during negotiations with an ongoing activity with the Air Force.

Dynetics received a rating of "Excellent" under the Relevance to NASA Objectives factor. EDRR 1, entitled "F1 Engine Risk Reduction Task," received a rating of "Excellent" under the Intrinsic Merit factor and a confidence level of "High" under the Price factor. The proposed price is reasonable for the proposed work. Dynetics' EDRR 1 will demonstrate use of several components for a gas generator (GG) rocket engine in connection with a LOX/RP booster. This EDRR effort provides a unique approach that will provide important data related to the GG cycle that will be used to inform future development decisions. This effort addresses the key risks and affordability concerns for the GG cycle.

As indicated, Dynetics received a rating of "Excellent" under the Relevance to NASA Objectives factor. EDRR 2, entitled "Main Propulsion System Risk Reduction Task," received a rating of "Very Good" under the Intrinsic Merit factor and a confidence level of "High" under the Price factor. The proposed price is reasonable for the proposed work. Dynetics' EDRR 2 will build and test components of the main propulsion system associated with a gas generator (GG) rocket engine for a LOX/RP booster. Significantly, this proposed EDRR addresses key technical risks for large LOX/RP systems that need to be resolved in order to enable competition for the Advanced Booster. The risks related to the main propulsion system are mitigated in this proposal with good value to the Government.

As indicated, Dynetics received a rating of "Excellent" under the Relevance to NASA Objectives factor. EDRR 3, entitled "Structures Risk Reduction Task," received a rating of "Excellent" under the Intrinsic Merit factor and a confidence level of "High" under the Price factor. The proposed price is reasonable for the proposed work. Dynetics' EDRR 3 will

demonstrate innovative fabrication techniques for cryogenic tanks. With this EDRR effort, Dynetics proposed a unique and potentially affordable approach for the manufacture of large liquid tank structures. If successful, this manufacturing approach could provide significant life cycle cost advantages and ensure future competition.

ATK received a rating of "Excellent" under the Relevance to NASA Objectives factor. EDRR 3, entitled "Integrated Booster Static Test," received a rating of "Very Good" under the Intrinsic Merit factor and a confidence level of "Medium" under the Price factor. The proposed price is reasonable for the proposed work. ATK's EDRR 3 will demonstrate innovations for a solid-fueled booster. This proposed EDRR addresses the key risks associated with low-cost solid propellant boosters, particularly in the areas of composite cases and materials. The future competition for an advanced booster will be informed by this proposed risk reduction activity.

While the EDRR efforts selected for negotiation were the highest rated proposals, the selected EDRR efforts also represent a diverse cross-section of technologies that will enable competition by mitigating Advanced Booster risks prior to the design, development, test, and evaluation of the Advanced Booster. Should negotiations not be successful or programmatic changes occur and additional funds become available, I may select additional EDRRs since all proposals will remain valid for one year.

Daniel L. Dumbacher
Deputy Associate Administrator for Exploration Systems

13 July 2012
Date